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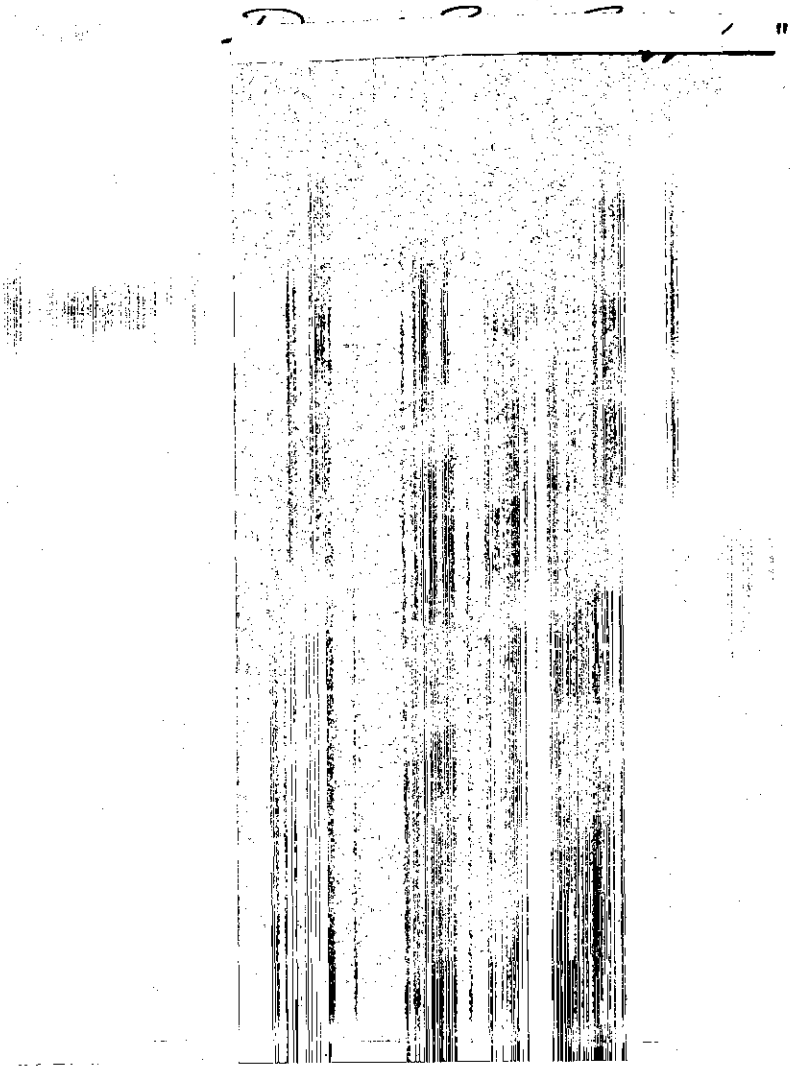

PLANNING FOR RECREATIONAL BOATING

A THESIS

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by

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SUMMARY

The provision of adequate marinas and other boating facilities has become a public responsibility over the past decade. The purpose of this study was to provide information and offer recommendations to assist the planner and local planning agencies in planning the location and space requirements of boating facilities, in specifying minimum site development standards, and in formulating and implementing a boating facilities plan for the community or region.

The methods used in gathering facts for this investigation were interviews with boat owners, marina operators, representatives of the Tennessee Valley Authority and the Corps of Engineers, other government officials, and members of local and state health departments. Pertinent literature was studied, boat facilities were examined and present regulations and standards were evaluated.

A marina site should be easily accessible, relatively level, and have suitable foundation conditions. The facility can be located adjacent to any use except one which emits obnoxious odors, smoke or noise. Marinas and other boat facilities serve as excellent transitional uses. A location within or adjacent to a waterfront park and within easy access to public services is considered best. Fluctuation of the water level, the location of bridges, harbor lines, navigation channels and protected areas, as well as water pollution, are important considerations.

The arrangement of the facilities and the parking and circulation of vehicles are the major factors of site development. Retail establishments should be located relatively near the berthing facilities but readily accessible to the highway. Storage and repair yards, launching ramps, and other ancilliary facilities are best located in an area away from the principal activities of the marina. The mooring area should be situated where conflict will not occur with boats entering and leaving the berthing facilities and in close proximity to the water entrance of the facility. Each facility at the marina should be provided with ample parking space. Roads throughout the site should follow contours. Adequate vehicular circulation and traffic control are essential.

This thesis recommends that local governments undertake a recreation boating study which consists of: (1) an inventory of existing recreation boating facilities; (2) a study of future demand for boating facilities; and (3) an analysis of the survey findings and the development of a boating facilities plan for the community or region.

CHAPTER I

INTRODUCTION

Recreational boating has increased at a rapid rate in recent years, but the development of boating facilities, both public and private, has not kept pace. Indications point to a continuing increase in boating with relatively little intelligent planning to meet the needs of the boating public. Without planning, existing and potential recreation boating problems may become very difficult to solve. The need for a program of planning for this relatively new recreational activity is therefore great.

The Problem

Since boating has evolved as one of the principal means of satisfying the recreational needs of millions of people and since private enterprise has not been able to provide the boating facilities to satisfy the demand, the reservation, acquisition and development of sites for such facilities is becoming more and more a public responsibility.

Purpose

The purpose of this study is to provide information and offer recommendations which will aid the planner and local planning agencies in:

planning the location and space requirements of boating facilities;

specifying minimum site development standards; and

formulating a boating facilities plan.

Methodology

Information for this study was obtained through interviews with boat owners, marina operators, representatives of the Tennessee Valley Authority and the Corps of Engineers, other government officials, and members of local and state health departments. Pertinent literature was examined, boating facilities were examined and present regulations and standards were evaluated.

The Growth of Recreational Boating

Pleasure boating was almost exclusively a rich man's sport at the beginning of the twentieth century. In 1904 there were 15,000 recreation boats in the United States. The appearance of the outboard motor in 1921 and the popularity enjoyed by boat racing resulted in an increase in the number of pleasure craft to about one million by 1925. During the early thirties the large, luxurious racing craft declined in popularity as smaller boats powered by outboard motors grew in numbers. Cruising and fishing replaced racing as the dominant boating activity. A phenomenal increase in the use of boats for recreational purposes occurred from 1940 to 1950. This increase became especially significant after the end of World War II. In 1947, seven million boating enthusiasts were operating 2,440,000 pleasure boats. By 1953, twenty million people were using 5,023,000 small craft as the boating industry began to experience the effects of increased family income and leisure time.[1] Today the number of recreational boats in the United States totals

approximately eight million, and it is estimated that about forty million persons participate annually in recreational boating.[2] This increase is evidenced by the upward trend in the use of reservoir areas as compared to other recreation areas. The annual average percentage increase in the use of recreational facilities since 1945 is as follows.[3]

	per cent
National Park System	8
National Forests	10
National Wildlife Refuges	12
TVA Reservoirs	15
Corps of Engineers Reservoirs	28
State Parks	10
Municipal and County Parks	4

The increasing use of boats on existing reservoirs has, apparently, been a factor in the percentage increase. However, part of this gain, especially on the Corps of Engineers reservoirs, is attributable to the fact that new reservoirs have made more water areas available for use.

Since World War II, the number of recreational boats has increased at a rate almost twice that of the increase in automobiles.[4] During this period of rapid increase, several significant changes occurred in the type of boats purchased. These changes are, in fact, partially responsible for the increase. First, the big schooner became almost non-existent and in its place appeared large numbers of 35-to 40-foot yawls and ketches. This change was followed by the emergence of prams, skiffs and small sailing craft as the favorite boat of many people. Such craft increased from around 600,000 in 1947 to over 1,500,000 in 1958.[5] The third and

most drastic change was the increased use of outboards. In 1947 only 1,300,000 outboards were in use; however, today, according to estimates of the Outboard Boating Club of America, some 5,000,000 outboards ply the waters of the United States. The number of outboard motorboats in use today represents about 70 per cent of all boats used on American waterways.

If the past ten years represent a continuous trend in recreational boating, it is possible that estimates of twelve million pleasure boats in the United States by 1985 will become a reality. Regardless of whether this prediction is correct, it is evident that boating has found a permanent place in the American way of life. Its present success and potential have made it imperative that plans for the future growth and development of recreational boating be prepared promptly.

Factors Contributing to the Growth of Recreational Boating

The growth of recreational boating has not been due to any one particular factor, but to many factors which have advanced recreational boating to an all time high in popularity. The principal factors, in addition to the already mentioned development of outboard motors, are:

Increased population

Urbanization

Higher incomes

More leisure time

Easier financing

Increased mobility

Technological advancements

Creation of water areas

Advertising.

Increased Population

The population of the United States has increased from four million in 1790 to 177 million in 1960 (according to the preliminary figures of the 1960 census of population.) Demographers attribute this fast population growth to the widening spread between birth and death rates and, to a lesser extent, to immigration.

If the National Association of Engine and Boat Manufacturers' estimate of forty million annual participants in recreational boating in 1960 is correct, about twenty-two per cent of the people living in the United States in 1960 will be using the nation's waterways. Even if this percentage remains constant and the projected population of 228.5 million for 1975 becomes reality, then in that year 50.3 million persons will be satisfying at least a part of their recreational needs through boating.

Urbanization

An urban area in the United States, as defined by the Census Bureau, includes places with a population of 2,500 or more persons, densely settled fringe areas around cities of 50,000 or more (a fringe area is one

having 2,000 or more population per square mile outside a major city), and unincorporated areas of 2,500 or more outside the fringes of any urban place. By this definition, according to Bogue, sixty-four per cent of the population of the United States in 1950 was urban and thirty-six per cent rural, most of the rural being urban-oriented.[6] Between 1950 and 1955 the total number of people in urban areas increased by twelve million--rising from 84,500,000 to 96,100,000.[7] Many population experts believe the 1960 Census will show seventy per cent of the nation's population to be residing in urban areas.

As a result of this rapid increase in urbanization a multitude of pressures have evolved--pressures which have created an unprecedented demand for all types of recreation, including pleasure boating.

Higher Incomes

Annual average income of the American family has risen from $651 a year, after taxes, in 1901 to $4,224 in 1950, to $5,610 in 1958 and to $6,520 in 1959.[8]

Another significant aspect of increased incomes is the creation of a new mass market resulting from a more even distribution of this greater income. While the number of households is projected to increase seventeen per cent during the period 1955 - 1965, the number of families receiving income of $3000 or more is estimated to increase fifty per cent, or three times as fast as the population.[9]

Increases in the number and percentage of families receiving higher incomes has permitted additional expenditures for recreational purposes. Retail expenditures on boating have increased from $645 million in 1951, to $950 million in 1953, to 1.2 billion dollars in 1955 and to 1.9 billion dollars in 1957.[10] It has been estimated that about 2.5 billion dollars was spent in the year 1959 in pursuit of the nation's new pastime.

More Leisure Time

The amount of leisure time available to the American public has risen over the past several decades. In 1900 a sixty-hour work week was common and as late as 1930 fifty hours represented an average work week. Today the eight-hour work day and forty-hour work week have gained universal acceptance. This standard, along with increased income, has enabled both the skilled and unskilled worker and the white collar and the blue collar worker to engage in recreational activities which were at one time the exclusive pastime of the rich. The current experiments with the four-day work week and its possible acceptance will result in even more time for activities such as recreational boating.

Other factors which have increased the amount of leisure time are more holidays, longer vacations, earlier retirement, increased mobility, and improvements in household appliances. In short, today's worker has more hours away from the job, makes more money, has attained a degree of freedom from household chores and can move from place to

place with much greater speed than the worker of twenty or more years ago. The result is, in many instances, more money with which to purchase boats and related equipment and more time to enjoy recreational boating.

Easier Financing

A survey conducted in 1957 by the Federal Reserve Bank Board of Atlanta to determine the extent and the manner in which banks have participated in boat financing revealed that two-thirds of the 125 institutions throughout the Southeast included in the study finance pleasure boats, but have been in this field for only about four years. The average banker required a down payment of between twenty-five and thirty-three per cent of his boat loans and allowed his customer to pay the balance in nineteen to twenty-four months. The interest rates on such discounted installment loans varied between six and eight per cent. Florida banks were found to be the most liberal in their terms.

Since the date of this survey, down payments and interest rates of banks in this region on boat loans have been reduced, while the length of maturity has remained about twenty-four months. Present interest rates and down payments are, generally, as follows:[11]

6% on loans up to $2,500;
5 1/2% on loans over $2,500;
25% down on small boats and runabouts;
25% down on cruisers and yachts.

The more liberal terms in Florida were attributed to the fact that pleasure boating has been popular for a longer period of time and, as a

result, lending institutions have had a longer time to experiment with and evaluate various plans. The changing terms of the First National Bank of Miami between January 1953 and January 1958 shows how down payments and interest rates have been lowered and debt retirement periods lengthened in Southern Florida. Originally, a down payment of one-third the retail price was required with a maximum maturity of fifteen months, or one-quarter down payment and a maturity length of twenty-four months. Maturities were further extended to thirty months in 1957 and later that same year, because of competition from other lenders, the down payment was lowered to fifteen per cent with thirty-six months to pay.[12] This latter plan is in effect today.

Another reason for the increased use of boats for recreational purposes has been banker-dealer agreements. Bankers have found that aid must be extended to the boat dealer by financing his inventory, if desirable installment loans in sufficient quantity are to be secured. Such financing is considered important for three reasons: (1) manufacturers very seldom have financing plans; (2) seasonal business necessitates increased stock prior to the selling season; and (3) the dealer who displays the actual boat has a distinct sales advantage.

Banks and other lending institutions have made boat loans readily available because such financing is good business. This is shown by the fact that over fifty per cent of the boats and boating equipment purchased today is financed through installment plans.[13]

Increased Mobility

Motor transportation has advanced from a position of relatively minor importance before World War I to one of vital importance by the start of the second World War. In 1916 there were 3.5 million vehicles of all types registered in the United States. By 1940 this number increased to 32.4 million. In 1956, 65.2 million vehicles were registered.[14] Estimates as to the number of vehicles in use by the year 1975 range from a low of 85 million to more than 100 million.

While motor vehicle registrations have grown at a rapid pace, an appreciable gain in the total miles of roadway has also increased mobility. Total mileage of roads has increased from about two million miles in 1904 to approximately three million at the end of 1955.[15] The increased amount of paved roads over this same period of time is significant. In 1904 only 140,000 miles of paved roads were in existence, but by 1921 surfaced roads in the highway system totaled 387,000 miles and by 1955 the total was nearly two million miles.[16]

An indication of the positive effect more and better roads have had on boating can be seen by the increased use of trailers for transporting boats. In 1947 only 3,790 boat trailers were purchased. In 1950 this number increased to 18,390; in 1955 to 129,000 and in 1958 to 168,000 boat trailers. It is estimated that over 1 1/2 million boat trailers were in use in 1958. Between 150,000 and 200,000 new ones are now being sold each year.[17]

As the number of automobiles increases, as additional roads are constructed and as existing roads are improved, accessibility to bodies of water is greatly increased.

Technological Advancements

The advantages of mass production have resulted in improvements in the design of boat hulls, in the types of materials used in hull construction, in the dependability and easier starting of engines, in new types of safety equipment and in the design of trailers used for transporting boats.

These new techniques have facilitated maintenance and operation, have made boating much safer, have made it possible for inland enthusiasts to participate in recreational boating and have placed boating within the reach of the man of ordinary means.

Since the new marine products that are continuously being developed attract additional boating enthusiasts, the use of pleasure boats in the future is almost certain to dwarf all previous participant records and consequently to increase greatly the need for well-planned boating facilities.

Creation of Water Areas

Thousands of acres of water area suitable for recreational boating have been created by the Corps of Engineers, the Bureau of Reclamation, the Tennessee Valley Authority and private organizations.

Corps of Engineers.--By 1956 the Corps of Engineers had developed 138 reservoirs. Approximately 2,830 access points to the waters of these reservoirs (an average of about twenty access points per reservoir) were provided. Also, 1,125 boat launching ramps were installed at ninety-four of the reservoirs, and approximately the same number of public boat landings were available.[18] Since 1956 a considerable number of reservoirs have been created and many more are under construction in the southeastern and northwestern portions of the United States. An example of a recent Corps installation is 38,000-acre Lake Lanier, which is located thirty-six miles north of Atlanta, Georgia. Evidence of the recreational use of the Lake can be seen from the fact that 4,500,000 person-day visits were made to Lake Lanier in 1959.

Tennessee Valley Authority.--In the Tennessee Valley, prior to 1933, there were approximately 600 pleasure boats in use on the then muddy and erratic Tennessee River. Since 1933, TVA has created on the Tennessee River and its tributaries a system of twenty-five lakes with a combined area of some 600,000 acres enclosed at full pool by 10,000 miles of shoreline. Nine of the lakes, on the main stream, form an interconnected chain extending 630 miles downstream from Knoxville, Tennessee, almost to Paducah, Kentucky. The lakes range in size from a few hundred acres to Kentucky Lake, the largest man-made lake in the world, whose 158,000 acres stretch for more than 180 miles. It has

been estimated that there are now more than 2300 cruisers, runabouts, and speed boats, 43,000 small boats and an undeterminable number of cartop boats in use on the TVA lakes.[19]

Bureau of Reclamation. --Notable among the Bureau of Reclamations multi-purpose projects are Hoover Dam, Grand Coulee Dam and Shasta Dam. The Hoover Dam, which is part of the Boulder Canyon project, has created one of the largest artificial reservoirs in the world. This reservoir is a national playground and recreational area. Grand Coulee Dam of the Columbia Basin project was completed just before World War II. Lake Franklin D. Roosevelt, impounded by the Grand Coulee Dam, extends 151 miles upstream to the Canadian Border. Shasta Dam, located in the Central Valley of California, was in 1950 the world's second highest dam. The reservoir provides 365 miles of shoreline and forty-seven square miles of lake surface available for recreational purposes.[20]

Power companies. --As a yardstick for determining the part private power companies play in the creation of water areas which are used for recreational purposes, information was obtained concerning hydro-electric installations by the Georgia Power Company. At present, there are twenty Georgia Power Company hydroelectric plants within the state. When the individual reservoirs are full the submerged land varies from twenty-two acres up to more than 15,000 acres. The total land submerged at full pool at the twenty reservoirs in Georgia is in excess of 36,000 acres.[21]

Advertising

Through various methods of advertising, the boating industry has informed the public of technological improvements and style changes in their products. This has undoubtedly helped to cause many individuals to purchase a boat or to "move up" to a larger craft.

On the national level, boat manufacturers spend a considerable amount of money on advertising boats and boating. For example, one leading builder of inboards spends annually some $600,000 for advertising.

A more recent innovation in boat and accessory sales promotion by boat dealers is the popular boat show. In the "Free Boat Show", the marine trade has an advertising technique which has paid dividends to the industry. The exhibitors in the National Motor Boat Show held in New York in January, 1959, called it a veritable gold mine. An estimated 415,000 persons spent $27 million while attending the display which covered seven acres. More than 20,000 boats valued at $10 million, inboard and outboard engines worth another $10 million and $7 million worth of accessories were purchased.[22]

The New York Boat Show was, at one time, the only one of its type, but today many such shows exist. Notable is the Chicago Show which displays no less than 850 boats.

Another form of advertising which has greatly influenced the purchase of boats is the promotional work done by boat dealers and bankers through co-operative programs. It is not unusual for a banker to exhibit

boats or motors in the lobby or windows of his establishment, with the dealer benefiting through increased sales and the banker through additional boat loans.

Importance of Planning for Recreational Boating

By reserving land and ultimately providing properly planned boating facilities a community can: (1) benefit economically; (2) often obtain additional operating revenue; (3) avoid pre-emption of the waterfront; and (4) satisfy recreational needs.

Economic Gain

A community can gain economically from money spent locally by new residents attracted to the area because of adequate boating facilities and from transient boatmen who find their needs satisfied.

Annual expenditures at the retail level for recreational boating is considerable. In 1959 an estimated $2.5 billion dollars (a gain of almost twenty per cent over 1958) were spent for new and used boats, trailers, engines, fuel and oil, boat and engine maintenance and repair, launching, storage, accessories, safety equipment, insurance, and boat club memberships.[23] An estimated 404,057,000 gallons of gasoline and 20,266,000 gallons of lubricating oil were purchased for use in recreational craft during 1959.[24] The National Paint, Varnish and Lacquer Association estimates that 10,435,000 gallons of marine paints and varnish were used on recreational boats in 1958.

Additional Revenue

Local governments can often obtain additional revenue through (1) the charging of fees for the use of boating installations, particularly marinas; (2) new residents attracted to the community because of suitable boating facilities; (3) new businesses established to serve the needs of boating enthusiasts; and (4) increased property values, particularly in the vicinity of boating installations such as first-class marinas. Two examples of municipalities which have increased their operating budgets and their economy by constructing marinas are Fort Lauderdale, Florida, and Atlantic Highlands, New Jersey.

Fort Lauderdale's Bahia Mar, with facilities for more than 400 boats of all types and sizes, is one of the largest in the nation and has shown a profit each year since opening. It covers twenty-two acres of land and contains two restaurants, a twenty-eight-store shopping center, a marine supply sales store, a marine repair yard and 400 automobile parking spaces. During the 1949-50 opening season, 670 yachts paid dockage at the facility. Since that time the number of boats using the berths has risen ten per cent annually.[25] Bahia Mar merchants enjoy a $1,000,000 yearly gross business. Five marine supply stores in the City's central business area gross around $1,000,000 and approximately 950 people are employed in boat yards. Twenty-two regular employees, with eight additional during the winter season, administer and operate the marina. Within the first six months after the opening of the facility

more than one-half million dollars of near-by real estate was sold to boat owners using the marina.

In 1955, the Atlantic Highlands (New Jersey) Marina, which accommodates 400 craft, showed a net profit of $22,000.[26] This sum was a welcome addition to the operating budget of a community of only 4,000 permanent residents. Local businessmen state that much of their business is directly attributable to the marina.

Pre-emption of the Waterfront

An essential element of the "good life" for millions of Americans is the use of pleasure boats for maintaining physical and mental health. Water access areas are insufficient in number and are fast becoming overcrowded as the number of boating participants increases.

Throughout the country, areas that once offered a change of scenery and various forms of recreation for the city dweller are being engulfed by the metropolis. River banks have been pre-empted by private development and shorelines are following suit. For example, on Ohio's Lake Erie shoreline almost no beach areas have been reserved for public use. Likewise, along the Atlantic coast, most of the beach is restricted to private use. In 1956, the National Park Service in its publication, Our Vanishing Shoreline, alerted the Nation to the few remaining opportunities to preserve frontage on the Atlantic Ocean for the public but their warning has, except for the Cape Hatteras National Shoreline Park in North Carolina, thus far gone unheeded.

A re-evaluation of recreational needs and subsequent reserving of lands for future boating facilities is a critical necessity. In some sections of the country the need for boating facilities is so urgent and the land available for such development so limited that dealers cannot sell cruisers or yachts unless they can guarantee the prospective owner dockage space. As stated in the publication, The Modern Marina,

> It all adds up to the fact that increasing millions of our citizens and their families are enjoying this wholesome, healthful recreation. Therefore, the importance of boating as a recreational outlet should receive increased attention from city planners whose job it is to look into the future and adequately provide for such needs in their comprehensive plans.[27]

Satisfaction of Recreational Needs

Recreation is a basic human need in modern life and is important to the physical and mental health of individuals. The use of boats satisfies the recreational needs of an ever-increasing number of people.

Even though many bodies of water suitable for recreational boating have been created, the shortage of boating facilities remains critical. A survey conducted for the National Association of Engine and Boat Manufacturers, by the New York marketing research firm of Smith, Stanley and Company, Inc., disclosed that approximately 1,250,000 requests for slips and moorings were rejected during 1959 because of lack of facilities.[28]

CHAPTER II

THE LOCATION AND SPACE REQUIREMENTS OF MARINAS AND OTHER BOATING FACILITIES

Factors that require careful consideration when planning for boating facilities include:

determination of facilities to be provided and acreage required;

land requirements;

waterway requirements; and

availability of suitable sites.

Since reference is made to marinas, small-boat docks, launching sites and mooring sites throughout this and subsequent chapters these terms are defined here.

The generic word "marina" was introduced in 1928 by the National Association of Engine and Boat Manufacturers to describe the modern boat basin with facilities for berthing and servicing all types of recreational craft, as well as for providing adequate supplies, storage, maintenance and fuel.[29]

A complete marina provides most of the following conveniences:

Boat slips
Boat handling equipment
Repair and maintenance shops
Marine and hardware supply store
Boat and gear storage
Launching facilities

Fuel station
Restaurant
Club house
Motel or boatel
Commerical stores
Recreational facilities
Automobile parking
Spectator areas
Pedestrian walkways.

The small finger pier, the private dock or float, or other forms of anchorage which lack many of the above conveniences are not classified as marinas.

On the basis of the above definition the often-used term "small-boat marina" is a misnomer. In this thesis the term "small-boat docks" will be used.

Generally, a small-boat dock is designed to accommodate craft twelve to twenty feet in length at fixed or floating docks. In addition to berthing equipment a complete facility includes launching ramps, boat houses, a boat display area and sales office, service facilities, vehicular parking areas and a snack bar with rest rooms. Sometimes a motel or boatel is included at such a facility.

A launching ramp site is a facility for the launching and beaching of water craft carried on a trailer and for the parking of automobiles with and without trailers. Sometimes one or several docks are included at this facility to expedite the operation. Although launching ramps are often included at marinas and small-boat docks the facility referred to in this thesis is isolated from other marine installations.

Mooring sites accommodate boats in protected coves or lagoons which are removed from other boating facilities. In addition to piles or buoys for mooring purposes, off-street vehicular parking, access to the waterfront and a boat dock for the berthing of a boat for taxi service to and from the mooring area are included.

In the past, marinas and small-boat dock installations have been principally in private ownership, whereas isolated launching and mooring facilities have been publicly owned because they are normally not revenue producers. However, because of the tremendous increase in recreational boating and the failure of private enterprise to meet the demand for boat facilities the provision of marinas and small-boat docks as well as launching and mooring facilities has often become a governmental responsibility.

Determination of Facilities to be Provided and Acreage Required

The type and extent of boating facilities that should be provided are determined by estimating the number, types and sizes of boats included in the home fleet; the types and sizes of boats owned by local residents but berthed elsewhere because of lack of facilities; the number of transient boats in the area; the number, type and capacity of existing facilities; the local and regional growth in boat and boat-trailer ownership; and the population growth.

In many instances, much of this information might be secured by checking boat registrations, information recorded upon the purchase of boats, license plates or boat operators licenses, personal property tax lists, local insurance companies (boat coverage), boat maintenance and repair shops, boat storage facilities, dealers in new and used boats and boat club memberships.

A rough estimate of the future number of pleasure boats in a defined area can be obtained from the predicted population of the area. This method was used by a California consulting firm in projecting the number of berthing facilities needed within a twenty-year period in the vicinity of the Alimitos Bay Marina, Long Beach, California. Within the contributing area it was estimated that the population twenty years in the future would be three million persons. Using a unit figure of two boat owners per one thousand population (2.2 is the national average) it was estimated that facilities for six thousand pleasure boats would be required within the twenty-year period.[30]

Once adequate boating facilities are provided, the local boating situation may change materially. Not only do new boat owners appear but many owners of small boats are likely to purchase larger craft. As a result, the estimated boating facilities required may not be adequate unless this fact is taken into account. On the opening of a new marina, boats berthed average larger in length, beam and draft than the boats present in the area before the construction of the marina.[31]

The need for a marina, as opposed to small-boat docks or other facilities, is dependent upon the locality and the characteristics and extent of the waterways. A marina may be in demand on a waterway which transient boatmen navigate but it would not, except under special circumstances, be successful on a land-locked body of water with a small surface area. Also, the economic conditions dictate the type of boats purchased. Large yachts and cruisers are seldom seen in areas where the per capita income is low and transient boatmen are not present. In these areas small-boat docks, launching ramps or mooring facilities would need special consideration.

To estimate the number of transient boats in a given area it is necessary to determine the distance to and the size of other marinas within the region, the travel time required between facilities, the location of fueling facilities along the waterway, and the distance to open water, tourist centers, or other attractions.

After evaluating the data obtained concerning the size, type and number of boats anticipated and determining the approximate type and number of facilities needed, the acreage required for each type of installation must be established.

Acreage Required

Regardless of the minimum acreage suggested below for each type facility additional land should be acquired, whenever possible, to provide for future expansion.

Marinas.--Many marina operators believe that for a marina to be financially successful there should be a minimum of two hundred and fifty slips and that the site should comprise at least twenty-five acres. If fewer slips are provided the berthing fees as well as other sources of income will be so minimal that the cost of construction and maintenance cannot be justified. The twenty-five acre minimum site is considered necessary in order to provide ample area for the multiple operations of a marina and to insure adequate vehicular parking space.

Small-boat docks.--Unlike marinas with their many ancillary sources of income, small-boat dock installations rely primarily on dockage fees for their operating revenue. Because of this dependence upon slip rental fees the general agreement is that a small-boat dock facility should be designed to berth approximately one hundred craft up to twenty feet in length. The suggested minimum amount of land for a facility of this size is five acres. This land area is considered sufficient because of the limited number of on-shore structures necessary at a small-boat installation.

Launching ramp site.--Experience shows that several single or dual launching ramp installations located at various points along the waterway are more satisfactory than one multi-ramp facility. Well distributed launching ramps are in closer proximity to people and are likely to be less congested than one large facility. The minimum amount of land generally recommended for a single-ramp installation and adequate parking is two acres.

Mooring site. --The land area required for the parking of vehicles at a mooring site is largely determined by the number of boats moored. For each boat moored there should be at least one parking space but more than one space is desirable. If less than one space is provided many boat owners will probably be unable to park their vehicles on weather-perfect weekends or holidays. One and one-half spaces per boat moored would make available vehicular parking for each boat owner and also provide additional spaces for guests.

The minimum amount of land required for off-street vehicular parking at each mooring site can be estimated by allowing three hundred and fifty square feet (which includes maneuvering, right-angle parking and a two-way circulation system) for each parking space deemed necessary. One-quarter acre would thus accommodate approximately thirty-one vehicles but little land would remain for proper landscaping or access to the waterfront. Therefore, a maximum of twenty-five vehicular parking spaces per one-quarter acre appears to be a desirable standard.

Land Requirements

Factors which should be considered in the selection of sites for boating facilities are:

accessibility;

topography;

foundation conditions;

surrounding land uses; and

availability of public services.

Accessibility

One of the most important factors is access. The site itself might be improved with the most modern equipment and satisfy every need of the boatman but if it is not readily accessible it cannot fulfill its intended purpose or be financially successful.

If the entrance to a marine facility is located too close to railroad crossings, tunnels, bridges or other traffic deterrents, the entering or leaving of a facility is difficult and oftentimes impossible. Drawbridges which are raised and lowered for the passage of small craft are bothersome. The relation of the proposed facility to drawbridges should be given especially careful consideration.

After considering the physical structures which might interfere with traffic flow, the location of access roads to and from the facility merits study. Local governments often cannot or will not maintain access roads to waterfront recreation areas. An excellent example of this situation was found at Lake Lanier, located north of Atlanta, Georgia. This recent Corps of Engineers project annual attracts millions of people who reside in counties other than in which the lake is located. Prior to the creation of the reservoir the existing dirt roads were not objectionable; however, when these same roads were subjected to an almost continuous stream of automobiles on weekends and holidays the dust raised became

almost unbearable or, after rains the cars became immobilized.

Several states have realized that the financial burden of providing and maintaining access roads to boat facilities should not be borne entirely by local governments because many people are attracted to waterways who reside in counties other than those within which the body of water is situated. For instance, the State Road Board of Florida, in administering the 1959 "Water Access Law" adopted policies which provide for the improvement and maintenance by the state of access roads to boating facility sites. An extract from the policies approved by this department reads as follows:

> The Department may construct, if necessary, a connecting access road between a park or boat ramp site and an existing state road for a distance not to exceed 200 feet, and maintain same from the funds indicated above, provided the right-of-way therefor is vested in the Department. Access roads in excess of 200 feet shall be furnished and maintained by other agencies, political subdivisions or municipalities, except that secondary funds may be used for this purpose upon proper authorization by the Board of County Commissioners involved.[32]

A 1959 law in South Carolina authorizes the State Highway Department to provide access to any state highway from any public small-boat landing constructed and maintained by county authorities. The cost of improving such access roads is to be paid for from the maintenance fund allocated to the counties by the Highway Department. Obviously, laws such as those enacted in Florida and South Carolina aid in providing and maintaining access roads to shorelines. Assistance at the state level is necessary in many regions of the country if the recreational boating needs of millions of people are to be properly satisfied.

Although a boat facility should be within easy access of a major street or highway it should not be located on a tract of land which is limited in depth because of the nearness of the thoroughfare to the shoreline. A parcel of land which is very long and narrow complicates the ingress, egress, circulation and parking of vehicles, often prohibits adequate landscaping and sometimes necessitates the erection, at a much greater cost, of structures on submarginal land near the shore.

In summary, the major points to consider in regard to vehicular access to boating facilities are traffic deterrents located within a short distance of the facility, the inability of many local governments to provide and maintain access roads and hence the desirability of locating a facility near a major street or highway.

Topography

The topographic requirements of a site for boating facilities is dependent upon the type of installation to be constructed.

Approximately one-half the area of a site for a marina should be relatively flat, particularly in the vicinity of the shoreline, while the remaining part might have considerable variation in grade. A site which is almost entirely level simplifies on-shore construction and facilitates the parking and maneuvering of vehicles but a site which is partially rolling may be much more pleasing esthetically. However, if the tract of land selected for a marina is too hilly, the cost of developing the site is excessive. In addition to the extensive expenditures for regrading the

property, the numerous retaining walls necessary to provide level areas would be prohibitively costly. The structures and uses associated with a marina which require a flat terrain are the boat storage areas, the repair and maintenance yards, the launching ramp and boat-handling equipment area, the vehicular parking areas and the recreational facilities such as tennis and volleyball courts and baseball diamonds.

There are many uses at a marina which are adaptable to land which displays a variation in grade. Some of these are the restaurant, the commercial establishments, a club house, a boatel or motel and spectator over-look areas. Regardless of the uses best suited for specific areas of the site, whether flat or undulating, a trained site planner should be consulted to determine the best arrangement and relationships of the various uses at the time of site development.

A site selected for a small-boat dock installation does not have to be as unchanging in grade as that for a marina because of the fewer on-shore structures required at this type facility. It is important, however, to choose a site which is comparatively level and close to shore for the boat launching and retrieving operation. If a gear transfer area is provided in close proximity to the boat slips the parking of vehicles can occur at various graded levels which are connected by a series of steps. The principal uses and on-shore structures which are best situated on relatively flat land are the repair shop, the boat storage areas, the launching ramp and boat handling equipment area and the vehicular parking

areas. An especially important consideration at this type of facility is the approach area to the launching ramps. If this part of the site is steep and the ramp itself descends sharply a person unaccustomed to backing a boat trailer or launching and beaching water craft from a trailer is usually apprehensive.

Launching ramp sites should, ideally, have little change in grade in order to simplify the parking and maneuvering of vehicles with trailers by inexperienced persons. A portion of a site that is somewhat hilly might be developed for the parking of vehicles of persons watching the launching and beaching operation.

Foundation Conditions

Determination of the foundation conditions in both the land and water areas before purchase of the site is important because of increased development and maintenance costs if foundation conditions are not satisfactory.

Foundation conditions such as rock formations and the presence of silt loam, silty clay loam or similar type soils may prevent the successful development of a site. Where an extensive amount of rock must be removed to provide areas sufficiently level, the cost would be excessive. Likewise, if the subaqueous foundation is composed of rock the driving of piles for berthing facilities is much more difficult and sometimes impossible except at great cost.

Where silty soils are present, larger footings for on-shore structures are necessary and a greater depth of sub-base material beneath paved areas is mandatory. If proper footings and adequate sub-base material are not provided, a noticeable amount of settling and shifting will take place if excessive moisture occurs.

Should the land under water exhibit the same properties, extra long piles will be required to resist horizontal forces caused by boats bumping against the pier. These extra length piles will naturally be more expensive.

Another major problem which often results from a loosely compacted soil beneath the water is that of shoaling. When the marina installation is in a location where currents are prevalent a rapid accumulation of sediment at the entrance to the facility or within the vicinity of the slips or docks takes place. For this reason periodic dredging is necessary. If frequent dredging is an unforeseen expense, maintenance may become a definite liability.

Without exception, the foundation conditions of a prospective site should be determined in detail by means of sounding, of probings, of test borings and of test piles before a site is acquired. This should be accomplished to prevent unexpected expenditures in the development and maintenance of the facility.

Surrounding Land Uses

Previous to the early 1950's the objectionable noise of outboard motors relegated boating facilities to areas of the waterfront remote from dwellings. Since that time the noise of outboard motors has been reduced as much as ninety-five per cent. For this reason, if sites for boating facilities are properly selected and developed they could conceivably be located within or adjacent to residential districts. In California, for instance, many subdividers are now providing boating facilities of various types as an integral part of their subdivisions. These entrepreneurs have realized that the provision of boating facilities for those persons residing within the development serves as an inducement to purchase building lots.

A boating facility might well serve as a transitional use between districts. For example, a marina would be a desirable transition between a commercial and a residential district. Such a facility has characteristics which are applicable to both districts in that persons may reside on board ship for extended periods of time and commercial stores may be included in the development. When a manufacturing district is located adjacent to a residential area along the waterfront a boating facility, if needed in that vicinity, would serve as a good transition between these two uses. The access road to a boating facility could also function as an open space between uses which are not harmonious. Boating facilities might serve in a particular situation as an excellent transition between

other uses along or near the waterfront; therefore, their value as a transition between incompatible land uses should not be overlooked when selecting sites in areas where boating facilities are needed.

Many people consider the ideal location for boating facilities, particularly a marina, to be within the confines of or immediately adjacent to a waterfront park. There are several advantages of constructing a marina in such a location.

People who reside on board a boat are normally in confined quarters most of the time. For this reason they have a definite need for various types of recreation which can be obtained only on-shore. A park satisfies these recreational requirements in almost every respect. In fact, a boat owner who can treat his guests to a round of golf, a tennis match or even a game of croquet or shuffleboard will probably be a regular patron of the marina which can provide these on-shore recreational benefits.

Another advantage of locating boating facilities within or near a waterfront park is the possible availability of access roads. The cost of acquiring access road rights-of-way to a boating facility is often a major problem encountered by local governments when providing marine installations.

Access to Public Services

In urban areas, access to public services is seldom a major problem.

This is particularly true if the boating facilities are properly developed in conjunction with an over-all plan of improvement.

However, in rural areas and areas adjoining municipal boundaries potable water, sewerage facilities, and police and fire protection may be difficult to obtain.

Potable water. --Potable water is usually obtained in rural areas from underground sources by means of a well. Most states maintain a strict control over the location and the minimum depth of wells and the maximum amount of fresh water that may be pumped monthly. Usually a department within the state government is responsible for water-supply standards. The acquisition of a permit prior to construction is usually a legal requirement. Another means of providing water to boating facilities which are planned in rural areas is by extending the water lines of nearby municipalities.

Sewerage facilities. --Until such time as satisfactory marine toilets are developed adequate on-shore severage facilities must be provided at boating facilities, especially marinas.

There are several methods of providing sewage collection and treatment on-shore at marine installations when extension of municipal sewer lines is not practical. Three such methods are the septic tank, the group disposal system and oxidation ponds. If septic tanks are planned, extreme caution must be taken to determine whether soil conditions are favorable for their use.[33] When a marina is quite large and

there is a concentration of cottages or residences nearby a group disposal system may be the best solution.[34] Oxidation ponds have proven to be successful in rural areas but care should be taken in their location in order to avoid unnecessary antipathy.

The best location for a boating facility where on-shore sewerage collection and disposal is needed is within easy access of a public sewerage system.

Police protection. --The providing of police protection at boating facilities which are located in urban areas is seldom a problem but in rural areas this is often difficult because of inadequate community finances and the wide area of rural coverage.

At facilities where a supervisor is in residence or persons reside on board their craft vandalism of automobiles is not much of a problem. But when launching ramps or mooring sites are not supervised, the breaking and entering of vehicles is a common occurrence. Vandalism is especially bad at launching ramp sites because many persons fish late at night or in the early hours of the morning. Isolated locations for launching ramps are best avoided.

Fire protection. --Should a marina or small-boat dock installation be located outside the boundaries of a municipality, the fire protection service of that city may be extended to the facility. Usually this is done under contract between the city and individuals or special districts. However, an informal intergovernmental agreement for fire protection, when the facility is for a public purpose, is often possible. At a large

marina or boat dock facility which is too remote for practical extension of municipal fire-protection service other methods of fire protection are necessary.

Waterway Requirements

Accessibility

Three major factors in regard to access by water are: (1) depth and fluctuation of the water level; (2) existing and proposed bridges; and (3) proximity to open water.

Fluctuation of the water level. --The degree of water fluctuation varies with the body of water. At multi-purpose reservoirs the principal concern is drawdown. On rivers the size of the watershed and the amount of precipitation determines the amount of runoff. In coastal areas, tides are a major interest.

Drawdown decreases the value of a reservoir for boating, not only because of the lesser quantity of water available but because boating facilities are often left "high and dry." An example of the extent of drawdown at reservoirs is found in the TVA system. On the mainstream most of the reservoirs are lowered and raised only a few feet but on the tributary projects the annual range may be as much as one hundred feet.[35]

The locating of boating facilities on multi-purpose reservoirs requires special attention because of the fluctuation of the water level.

At Fontana Lake, North Carolina, concrete ribbons extending into the reservoir approximately one hundred feet have been constructed for the launching of boats from trailers. On some reservoirs steel mats are placed in position to serve as launching pads as soon as the shoreline dries out sufficiently. Floating docks attached to cables are often utilized. An example of this procedure can be seen at Norris Lake, Tennessee, where one boat-dock operator follows the receding water with his floating equipment for a distance of two miles.

When contemplating the location of boating facilities on a multi-purpose reservoir an "operating curve" should be inspected in order to determine fluctuations and the time they occur. To lessen the problem of drawdown, a facility should be located where the water is deep and the bottom drops off sharply.

When locating a boating facility on a river, careful attention should be given to the fluctuation of the water level. It is not unusual for some rivers at certain times of the year to carry a small volume of water and at other times to be swollen, uncontrolled devastators. An example of the unpredictable water level of rivers is the fluctuation of the Duck and the French Broad Rivers in Tennessee.

> The Duck River at Shelbyville, Tennessee, sometimes carries more than 60,000 cubic feet per second but it has been measured at five cubic feet per second. Likewise, the French Broad at Newport sometimes carries over 100,000 cubic feet per second and at times of low flow it is only about 200 cubic feet per second. With conditions like these it is readily apparent that over most of the miles of most of Tennessee the big question is how much water will be available at a particular place at a particular time.[36]

The selection of a site for a boating installation on waters which fluctuate markedly is very difficult. Although recent innovations in floating equipment have alleviated the problems of locating boating facilities on rivers it is, nevertheless, advisable to select sites which are situated in coves or other protected areas.

In some regions of the United States the tidal range is considerable while in other areas the range between high and low tides is small. In Maine, for instance, the range of tides is approximately eighteen feet while in south Florida a four foot range is normal. The Long Beach area of California experiences a tidal range of about nine feet. If a boating facility is planned on tidal waters, the elevation of normal high and low tides as well as those of occasional extremely high and low tides should be ascertained because of the minimum depth of water required for certain kinds of boats.

Determination of the fluctuation of the water level is important not only because of the minimum depth of water required for various type boats but the amount of change dictates to a large degree whether permanent docks or floating equipment is utilized.

Existing and proposed bridges. --Determining the location and clearance of existing and proposed fixed-span bridges is especially important when selecting a site for cruisers, yachts and sailboats. Almost as important is the location and the schedule of operations of all existing and proposed draw bridges.

Normally yachts and cruisers possess outriggers which extend sometimes more than ten feet above the superstructure of the craft and often necessitate the raising and lowering of draw bridges. Likewise, the masts of sailboats usually require the opening and closing of draw-spans. If the boat owner is compelled to wait while several bridges are raised and lowered before gaining access to open water he will likely visit facilities where this inconvenience does not exist.

The Corps of Engineers has been vested with the authority through sections five of the River and Harbor Act of August 8, 1894 (28 Stat. 362; 33 U.S.C. 400) to establish regulations which govern the operations of all bridges on navigable waters of the United States. However, federal regulations have not been established on all waters under the Corps' jurisdiction. In the absence of federal regulations, bridges over intrastate waterways may be governed by regulations established by the owners of such bridges. Copies of federal regulations relating to drawbridges may be obtained from the District Engineer of the Corps of Engineers.

Proximity to open water.--Easy access to open water should not be overlooked as a factor to be considered in the selection of a boating-facility site. The ideal location is a protected area within a short distance of a navigable body of water. Such a location is desirable for two reasons. First, close proximity to open water often reduces dredging costs. Secondly, the elimination of an excessive amount of

travel on narrow approach channels or small streams in order to gain access to open water reduces congestion and, consequently, the number of accidents.

The extensive dredging sometimes required to provide approach channels, mooring areas or turning basins is very costly and can obviate all the other advantages afforded by a particular site.

A boat owner who is compelled to travel a considerable distance in order to gain access to open water will do so only until a better located facility is available. Nothing is more exasperating to the owners of larger craft or sailboats than to traverse a channel or body of water which is limited in width and congested with a multitude of small craft piloted by inexperienced or irresponsible operators who often cause accidents. This is especially true of the sailboaters who pride themselves on skillful ability to match wits with wind, tides and currents, without the crutch of a gasoline engine.

Harbor Lines and Navigation Channels

When contemplating a boating facility on a navigable waterway of the United States it is important to understand what constitutes a harbor line and what effects this line has on site selection for boating facilities. Also, the advantages of locating the facility on a Federally improved and maintained navigation channel should be realized.

Harbor lines.--Harbor lines are usually established by the Corps of Engineers, but local governments may also establish these lines. In

some instances, particularly when the harbor is small or narrow, only one line is established and is designated as the "pierhead and bulkhead line." When the water area is not constricted there may be both a "pierhead line" and a "bulkhead line." If both lines are established, they are known collectively as "harbor lines." Harbor lines may or may not coincide with channel lines. A bulkhead line is the channelward limit for solid-fill type construction whereas construction beyond the bulkhead line is limited to open pile type piers, floats, mainwalks, catwalks and fender and anchor piles. Beyond the pierhead line all types of construction are prohibited. The width between these lines may be too narrow to permit the construction of a marina, a small-boat dock installation or a mooring site. Bulkhead lines can be changed, but since this process is time consuming and very involved it is not usually feasible.

Obviously, the limitations imposed on construction by established harbor lines might necessitate locating boating facilities on a site where more water area is available for the installation of off-shore structures.

Navigation channels. --If boating facilities are located on Federally improved and maintained navigation channels, periodic expenditures by local governments for dredging are eliminated.

The Federal Government improves and maintains only those rivers and harbors for which Congress has adopted a plan of improvement and allocated funds. Considering that the procedure by which a waterway

project becomes authorized is prescribed by law and is very time consuming, locating a boating facility on a body of water on the presumption of future Federal improvement involves a risk which might be difficult to justify.

Protection Against Wind, Waves, and Current

It is not unusual to find boat owners traveling a considerable distance to take advantage of boating installations which are situated in a location which is removed from (1) strong prevailing winds, (2) excessive wave action and (3) swift currents.

Protection from prevailing winds, which often create high waves and place undue stress on deck hardware, can sometimes be obtained by locating the boating facility on the leeward side of a hill or knoll, alongside wooded areas or adjacent to tall buildings.

Waves, formed on large bodies of water by distant storms or the wake of large vessels, which strike a boating facility directly, often cause considerable damage to docked boats and the marine installation. Likewise, the entering or leaving of a boating facility which is subjected to rough water requires skills which the majority of the more recent purchasers of water craft do not possess. In some locales, particularly along sections of the California coast (which comprises one-sixth of the total ocean frontage of the United States) these protective areas are nonexistent. If this situation exists, the construction of one or more breakwaters is required. A breakwater increases the cost of developing a

boat basin appreciably, but it must be given consideration when locating a boating facility along unprotected coastal areas.

Sometimes a breakwater serves a dual purpose in that it not only reduces waves but also causes the accumulation of sand on the lee side which can periodically be pumped on shore to replenish depleted beaches. When this situation exists the cost of constructing a breakwater might be more easily justified.

If a marine installation is planned on a river with a large watershed it is advisable to select a location which is clear of the main current. Sometimes the normal water velocity of a large river, especially if the current is broadside, might endanger craft putting in or leaving the facility by forcing it against piling, docks, or other craft. Also, boats which are unprotected from swift currents often break loose from their moorings and are damaged severely. Sometimes jetties are constructed to reduce excessive currents, particularly along coastal regions.

The hazards created and the damages extended to marine structures and water craft from strong winds, excessive waves and swift currents emphasize the need for locating boating facilities, whenever possible, in a partially land-locked cove or lagoon. Such a location is frequently desirable even at somewhat higher initial cost.

Water Pollution

Many bodies of water are polluted by industrial and domestic wastes.

An additional cause of water pollution is the dumping of raw sewage from an ever increasing number of boats equipped with marine toilets. On many bodies of water the conditions resulting from this practice have become so bad that it has become necessary to prohibit bathing and swimming. Boat manufacturers are working on the development of a satisfactory unit which could be attached to marine toilets for the treatment of body wastes prior to discharge into recreational waters. Until such time as municipalities prohibit the use of boats which discharge raw sewage into waters used for recreation or until boat manufacturers develop an adequate chemical toilet and it is made unlawful to dispose of untreated domestic wastes in waterways of the United States, the location of boating facilities accommodating vessels which possess marine toilets must be given careful thought.

The best location for a boating facility which berths craft containing toilets is on a stream of moving water. On bodies of water where there is no appreciable current a well-planned arrangement of flushing channels and automatic flood or tide gates is of some assistance. In all instances, stagnant bodies of water should be avoided.

Availability of Suitable Sites

A land-use survey of waterfront properties with special emphasis on vacant land and blighted areas should be one of the first steps in determining the location of boating facilities. Upon completion of this

survey properties found to be vacant or blighted should be designated on a map in order to determine their relationship: (1) to each other; (2) to existing boating installations; (3) to surrounding land uses; (4) to major streets; and (5) to present and future park and recreation areas. A property ownership study should be conducted for those tracts of land deemed potential sites for boating facilities. Also, an investigation of the availability and the cost of the properties involved is important. Purchase agreements are often complicated by complex ownership patterns and land speculation. Complications sometimes make it necessary for local governments to take legal action to acquire land for boating facilities.

If much of the available vacant waterfront land is in small parcels, these tracts might serve very adequately as launching ramp sites or provide access to an off-shore mooring area, if it is determined that such facilities are needed.

Summary

To ascertain the type and extent of boating facilities needed, a survey of the existing fleet and an estimation of the future fleet is necessary. After estimating the facilities needed, the acreage required for each type facility should be determined. The suggested minimum number of boat slips for a marina is two hundred and fifty and the minimum amount of land is twenty-five acres. A small-boat installation should

accommodate at least one hundred boats and should comprise at least five acres. Isolated sites for a launching ramp should be approximately two acres. The land area required at a mooring site depends upon the number of boats moored. One and one-half vehicular parking spaces (ten feet by twenty feet) for each boat moored is a good standard.

Sites selected for boating facilities should be within easy access of a major thoroughfare, should be relatively level and should not be composed of rock or other material which would increase the cost of construction.

Boating facilities can be located adjacent to almost any use except those which emit obnoxious odors, smoke or much noise. The ideal location for boating facilities may be within or adjoining a waterfront park. Marine installations may serve as a transitional use between incompatible land uses.

When possible, boating facilities should be located within easy access to a municipal water supply, sewerage facilities and police and fire protection. If municipal services are not readily available other methods of providing services must be devised.

The waterway upon which boating facilities are located should be given careful consideration. Of major concern is the fluctuation of the water level, existing and proposed bridges, and proximity to open water. The location of harbor lines is important because of the restrictions

imposed upon construction. By locating boating facilities, whenever possible, on federally improved and maintained channels the cost of dredging by local governments is eliminated.

An important consideration when selecting sites for boating facilities is protection against wind, waves and current. The best location is in protected coves or lagoons. If the waterway upon which a boating facility is located, particularly marinas, does not possess sufficient current the disposition of sewage from boats is a major problem. In all instances, stagnant bodies of water should be avoided.

A waterfront land-use survey to locate sites suitable for boating facilities is essential. Often sub-marginal lands or blighted areas can be utilized for boating facilities.

If careful thought is given to the principal factors which should be considered when planning the location of boating facilities, these facilities will satisfy the recreational needs of many people and will be an asset to the community.

CHAPTER III

MAJOR FACTORS OF SITE DEVELOPMENT

The purpose of this chapter is to list and discuss the principal factors to be considered in planning boating facility sites. An awareness of these factors will assist the planner in selecting suitable areas for boating facilities and in the formulation of minimum site development standards.

Although the following discussion is concerned with the planning of a marina site, much of the information pertaining to marina facilities is applicable when planning other type boating facility sites. The two principal factors to be considered when planning a marina site are: (1) the arrangement of facilities; and (2) the parking and circulation of vehicles.

Arrangement of Facilities

The principal marina facilities which should be located with regard to function and relationship are: (1) piers and slips; (2) retail establishments; (3) storage and repair yards; (4) launching ramps; and (5) mooring areas.

Piers and slips. --The off-shore water area selected for the berthing facilities should ideally be centrally located between the marina property

lines. Such a location is desirable because conflict with adjacent waterfront activities is improbable, the berthing facilities are easily accessible from all parts of the site, a more efficient utilization of the land area is possible, and noise or other disturbances from adjacent properties are less noticeable. Prior to the installation of the piers and slips an investigation of riparian rights should be made to determine whether future land fill or construction might prevent access to the berthing facilities.

Although the piers and slips are usually arranged perpendicular to the shore, some marina operators contend that a fan-shape arrangement accommodates all types and sizes of boats with a minimum of dredging and utilizes the water surface area between the piers and slips more efficiently. In this arrangement the slips for the larger, less maneuverable craft are located where the water is deepest and the distance between the piers and slips is greatest while the slips near shore are designed for shallow draft boats which do not require as much area for maneuvering. Furthermore, by arranging the slips in this manner a natural and desired grouping of the large sailboats, the expensive yachts and cruisers, the medium size powerboats and the outboard motorboats is permitted. The maneuvering distance required between the piers and slips for inboard motorboats is one and one-half to one and three-quarters times the length of the boat to be berthed.[37]

When most of the boats in a certain locality are the larger inboard motorboats, eight to ten feet of water may be needed at the boat slips near shore. This depth of water can be secured by dredging, by locating the piers and slips farther off-shore and providing mainwalks or footbridges to the berthing facilities or by extending the shoreline with land fill and constructing a retaining wall. A retaining wall, if of sufficient height and strength, permits the installation of walks, structures, and hoisting equipment immediately adjacent to the edge of the water and results in better utilization of the land area. If a structurally sound wall is not required the placement of a conglomeration of stones (rip-rap) on the shore will prevent erosion.

Retail establishments.--Often there is a sufficient number of businesses at a marina to constitute a modern shopping center. In locating the shopping center five major factors should be considered. These are: (1) the commercial stores should be relatively close to the berthing facilities to insure easy access for the boatmen; (2) a sufficient amount of land should be retained between the retail businesses and the slips so that access to the berthed boats is not impeded, spectator areas can be provided and adequate landscaping is possible; (3) the shopping center should be situated on relatively level land to reduce the cost of construction and facilitate access; (4) the center should be in such a location that it is easily accessible from the main entrance of the facility and other parts of the site; and (5) the commercial establishments (including a

motel or boatel) should be visible and readily accessible from the highway in order to attract potential customers.

The commercial stores within the center should be grouped according to function, pulling power, visual access requirements, and service needs.

The providing of adequate landscaping in the vicinity of the commercial stores is important. Carefully selected plant materials which have been properly located add to the aesthetic appearance of the shopping center and to the general appearance of the marina.

Storage and repair yards.--Boat storage may or may not be provided in conjunction with the repair yard; however, it is usually located within the same area because much of the boat handling equipment is used for both operations. The land upon which the storage and repair yards are situated should be comparatively level to facilitate the handling and storage of boats. Because this facility should be fenced to provide security for the boats and equipment and to exclude spectators, it is best located away from the main activities of the marina yet close to the shoreline.

The area requirements for boat storage will be determined by the size and types of boats to be stored and the type of storage deemed best in a particular locality. If ample waterfront is available enclosed boathouses might be best, or if the waterfront is limited on-shore storage would be required. Normally, daily or even weekly storage is limited to

small boats which are easily and quickly launched or recovered. Yet, in south Florida at least one marina operator hoists large cruisers ashore on a daily basis. These craft are stored on individual trailers.

Often, small sailboats are removed from the water and stored on trailers at the marina. If this is to be done, the area requirements for the storage of small sailboats on trailers should be considered when planning the marina site. Also, many owners of outboard motorboats prefer to leave boats stored on their trailers at the marina, if an adequate storage area is available. In the past such storage areas have not been provided at marinas. The demand for storage areas for this purpose should be determined prior to site development.

Launching ramps.--The location and character of the launching ramp sites are especially important for three principal reasons: (1) the ramp approach area and the parking area for vehicles towing boat trailers usually require a considerable amount of land; (2) the land area provided for the launching and beaching operation should ideally be between two to five per cent in grade; and (3) many persons who own portable boats enjoy fishing during the night or early morning hours; consequently, the noise created and headlight glare could disturb adjoining property owners or persons who reside on board craft at the marina. These factors necessitate locating the launching ramps on land which is no more than five per cent grade, which is removed from the berthing facilities and which is not in close proximity to adjacent properties.

Heavily planted buffer strips at least ten feet in width along property lines reduce noise and eliminate headlight glare. As a result, marina facilities can often be located closer to the property lines than would otherwise be possible.

Mooring area.--The mooring area for boats is best located where there is minimum conflict with craft entering or leaving the berthing facilities, where interference with adjacent waterfront uses is negligible, where the craft are protected from high waves and boat wakes and where the water entrance to the marina is easily accessible. Easy access to the water entrance of the facility is especially important when the moored craft consist mainly of sailboats because of restricted maneuverability.

Taxi service to the mooring area is a necessity. Separate docks for the taxi boats should be provided near the vehicular parking area to facilitate transfer of gear. Since normally no on-shore structures are necessary in the vicinity of the mooring area the shoreline topography may be rather steep.

Vehicular Parking and Circulation

After resolving the location of the principal marina facilities vehicular parking and vehicular circulation should be studied.

Vehicular parking.--Adequate parking must be provided in the vicinity of the berthing facilities, the shopping center, the boat storage and repair yards, the launching ramps and the mooring area.

In estimating the number of parking spaces required in close proximity to the berthing facilities the parking requirements of the persons who reside on board boats, of the local residents who berth craft at the facility, of tourists, and of spectators must be considered.

Contrary to general opinion, the persons who reside on boats at the marina require parking spaces because they frequently rent one or several cars for personal or guest use. Also, it is not uncommon for residents of large craft to receive frequent visitors who arrive by automobile. If parking spaces are not provided for these people, many spaces meant for others will likely be pre-empted. For this reason one vehicular parking space should be provided for each slip designed to accommodate craft upon which persons reside.

Usually the boats permanently berthed at a marina are owned by local residents. These persons often invite friends to accompany them on boating trips. To provide adequate vehicular parking for these persons and their guests, one and one-half parking spaces per boat secured at the marina (excluding transients) are recommended.

When commercial craft are berthed at the facility a considerable number of tourists enjoy sight-seeing tours and fishing expeditions. Most of the people arrive by automobile and therefore desire parking spaces close to the commercial craft. One parking space per three seats on the commercial craft is recommended by many commercial boat operators.

Many people enjoy watching instead of participating in boating activities. Spectators are normally present at most boating facilities, particularly marinas. If parking spaces are not provided for spectators in close proximity to boating activities, parking spaces intended for others will be occupied, congestion will result from vehicles parked improperly or accidents will occur while the spectator is sight-seeing while driving. To alleviate these possibilities several small parking areas should be constructed for spectators near the boat slips and near other water-oriented activities.

Few people will frequent the marina shopping center unless adequate vehicular parking is available immediately adjacent to the commercial establishments. The ratio of three to four square feet of parking area to each square foot of floor space devoted to retail business is often recommended.[38] Although the provision of vehicular parking for the retail store lessees and employees might seem insignificant, such an oversight might be regretted if these people use parking spaces needed by shoppers. One parking space should be furnished each lessee and employee of the commercial businesses.

The parking area to serve the boat storage and repair yards will be used primarily by persons employed at the facility. One parking space for each two employees of the storage and repair yards is usually adequate because of the common utilization of employee car pools.

Because of the overall length and decreased maneuverability of

vehicles with boat trailers the parking areas for these combinations must be individually designed. It has been found best to provide straight-through parking stalls in order to eliminate the need for backing trailers from parking spaces because this operation is especially difficult for the novice. These stalls should have a minimum width of ten feet, be at least forty feet in length, and be located at an angle of approximately forty-five degrees. The circulation aisle between the rows of stallsare of inadequate width if they are less than twenty feet. Turning lanes for vehicles with trailers require a minimum radius of forty feet. The number of parking stalls required in the vicinity of the launching ramps is dependent upon the local demand but to provide less than thirty stalls and room for expansion would be unjustifiable in most instances.

Persons who moor craft at a marina prefer that the vehicular parking area for them be located within easy access of the shore unless an area is reserved along the waterfront for the transfer of gear. Since the owners of sailboats frequently take friends sailing one and one-half parking spaces per boat moored at the facility is desirable.

After estimating the number of parking spaces or acreage required at each of the principal marina facilities the circulation and parking of vehicles within the parking areas should be considered. Unless special circumstances warrant otherwise a two-way traffic pattern with perpendicular parking stalls should be installed. When the two-way perpendicular stall parking design is utilized the stalls should be ten feet in width and

twenty feet in length. Each of the circulation aisles between the rows of stalls should be twelve feet wide.

Vehicular circulation.--Whenever possible the roads servicing the marina facilities should follow the natural contours of the site. Grades of ten per cent or less should be used because gradients which are greater are difficult to traverse.

The number of intersections should be kept to a minimum and when they are necessary should occur where the land is relatively level. Such a location permits visual access and thereby reduces the number of accidents.

A main road should lead directly to the berthing facilities and shopping center area. All other roads would be subordinate to this road. Where junctions occur along the main road and at the entrance to the facility, proper channelization of vehicles is imperative. Also, acceleration and deceleration lanes should be installed at the main entrance to the marina to alleviate traffic congestion and to help prevent accidents.

Summary

Two principal considerations in planning the marina site are the arrangement of the facilities and the parking and circulation of vehicles.

The berthing facilities and retail businesses should be in a central location along the shoreline; however, the retail establishments must be accessible from major traffic arteries. The storage and repair yards

and launching ramps are best located away from the principal activities of the marina. The area selected for the mooring of boats should be located where conflict with craft entering and leaving the berthing facilities is unlikely.

After arranging the marina facilities the parking of vehicles should be considered. The parking requirements of visiting boatmen, of local residents who dock craft at the facility, of tourists, and of spectators should be determined. In planning the parking area for the shopping center, the customer parking needs and the parking requirements of the lessees and employees of the retail businesses must be known. Likewise, the parking spaces required by the employees of the boat storage and repair yards should be provided. Since the sailboat owner often invites friends to go sailing, an adequate number of parking spaces should be provided in the vicinity of the mooring area.

After determining the location and size of the parking areas, the circulation of vehicles requires consideration. Roads throughout the site should follow contours and should be constructed at a grade of not more than ten per cent. Intersections should be few in number and should occur where the site is relatively level. Adequate traffic control devices are necessary at all intersections and at the entrance to the marina.

CHAPTER IV

THE LOCATION, ACQUISITION AND ZONING OF RECREATIONAL BOATING SITES

During the past decade the United States has experienced a tremendous increase in recreational boating and an unprecedented demand for marinas and other boating facilities. Private enterprise has provided many facilities but has been unable to keep pace with the rapid growth of boating. This lag has resulted in a progressively increasing shortage of boating facilities. The pre-emption of waterfront property suitable for boating facilities is another problem which is becoming continually worse. A shortage of available waterfront space results in high land values which often prevent the development of needed boating facilities. These problems are requiring public action for the reservation, acquisition and development of boating facility sites to meet the boating public's needs. Local governments should undertake a study of recreational boating to understand the existing problem and to determine what actions are necessary to achieve adequate boating facilities.

Recreation Boating Study

A recreation boating study might be included as an element of the park and recreation study or it might be a separate special study. The

study's purpose would be to evaluate the status of existing boating facilities, to estimate the demand for facilities, to obtain information for the formulation of adequate plans and policies and to insure the coordinated development of boating facilities with the overall plan of community improvement.

Active participation in the study by local residents and civic groups should be encouraged. Not only will this create interest in the boating problem but will likely result in increased interest in the entire community planning program.

The recreation boating study might consist of the following three phases: (1) an inventory of recreation boating; (2) a study of the demand for boating facilities; and (3) analysis of the findings and plan development. After completion of the third phase of the study an investigation of the tools most appropriate for carrying out the plan should be undertaken.

Inventory of recreation boating. --Following is a checklist which may serve as a guide in making an inventory of recreational boating:

Survey of existing conditions

- Local and transient fleet
  - Power
    - Inboard
    - Outboard
    - Sail
  - Hull length
  - Beam
  - Draft
  - Mast height
- Shoreline
  - Extent of shoreline

- Harbor lines and navigation channels
- Vacant land
- Blighted areas
- Parks and other lands in public ownership
- Ownership of suitable sites
- Sites available
- Cost of sites
- Depth and fluctuation of the water
- Width of waterway
- Protected areas
- Pollution
- Obstructions
  - Bridges
    - Fixed-span
    - Draw-span
  - Others

Accessibility
- Major street or highway
- Access road
  - Width of right-of-way
  - Width of roadway
  - Maintained
  - Not maintained
- Traffic deterrents
- Traffic controls
  - Signal lights
  - Sign controls
  - Acceleration and decleration lanes
  - Others

Surrounding Land Uses
- Public
- Semi-public
- Residential
- Commercial
- Industrial
- Mixed uses

Utilities and Services
- Potable water
- Sewage collection and disposal
- Police protection
- Fire protection
- Garbage collection

- Electric power
- Public transit

Methods of Administration, Operation and Finance

Marine Installations
- Site characteristics and other pertinent data
  - Ownership
  - Acreage
  - Mean length
  - Mean width
  - Length of shoreline
  - Type of bank protection
  - Topography
  - Foundation conditions
    - Land
    - Water
  - Landscaping
    - Buffer strips
- Type of facilities
  - Marina
  - Small-boat docks
  - Launching ramp site
  - Mooring site
- Number of facilities
- Number of boating accommodations
  - Slips
  - Ramps
  - Mooring spaces
- Condition of facilities
- Ancilliary facilities
  - Retail establishments
    - Type
    - Number
    - Condition
  - Club house, administration building, etc.
  - Boat storage yard
    - Type of storage
      - Wet
      - Dry
      - Seasonal
      - Daily or weekly
    - Capacity of yard
  - Fuel station

- Recreation
  - Type of facilities
  - Numbers of facilities
- Vehicular parking
  - Size of areas
  - Number of areas
  - Number of parking spaces
- Circulation roads
  - Number of intersections
  - Width of roadway
    - Improved
    - Unimproved

Study of the demand for boating facilities. --After making an inventory of recreation boating a study should be made of the demand for boating facilities. The following might be included in the study:

- Estimation of future fleet
  - local population growth
  - family income change
  - trend in boat and trailer sales
  - trend in boat registrations
  - engine and boat manufacturers estimates
  - boating plans of local residents
  - transient potential
  - effects of technological advancements
  - proposed water areas
- Facilities needed
  - type of facilities
  - number of facilities
  - capacity of facilities
    - slips
    - ramps
    - mooring spaces
- Acreage required
  - marinas
  - small-boat docks
  - launching ramp sites
  - mooring sites
- Development of standards

Analysis of findings and plan development. --After surveying the existing facilities and studying the recreational boating demand a thorough analysis of the information obtained is requisite if adequate policies and plans are to be formulated. The completion of the analysis may show that nominal improvements to existing facilities are all that is required or that extensive facilities may be needed immediately. Regardless of the extent of the facilities needed a boating facilities plan should be developed in order to coordinate improvements with the overall community or regional plan of improvement.

The boating facilities plan would include a text and a map. The text would contain: (1) an explanation of the purpose and function of the plan; (2) a description of the sites delineated on the map; (3) an evaluation of existing facilities; (4) a discussion of proposed facilities; (5) an explanation of the priorities established for reservation, acquisition, and development; (6) specification of minimum site development standards; and (7) recommended tools for the reservation, acquisition and development of the proposed sites.

The map portion of the plan would designate: (1) the type and size (number of slips or ramps, etc.) of existing facilities, their location, and the acreage involved at each site; and (2) the type and size of proposed facilities, their approximate location, and the minimum land area required at each site.

Each department of the local government concerned with a boating

facilities plan should be consulted for technical advice and recommendations. In addition, boat owners, site planners, marina operators, the state highway department and the Corps of Engineers should be consulted.

The boating facilities plan should be developed as part of the plan of improvement for the community or preferably the region. It should be reviewed periodically and revised to meet changing needs. Also, it is important that an active program of acquisition and development of the sites reserved for boating facilities be instituted if the boating facilities plan is to fulfill its intended purpose.

Tools for Carrying Out the Plan

A thorough investigation of each of the basic tools which might be utilized in carrying out the boating facilities plan is imperative. For the purposes of this thesis the discussion of all tools except the following will be omitted: (1) purchase and leaseback; (2) gifts and transfers; (3) tax foreclosures; (4) urban and rural redevelopment; (5) formal and informal agreements; and (6) zoning.

Purchase and leaseback. --Outright purchase is the most desirable method of obtaining boating facility sites. However, the use of public funds for such a special purpose is sometimes limited to a percentage of the general tax revenue or to specific appropriations.[39]

Private enterprise may be interested in leasing the acquired property for the installation of revenue producing facilities. If this is the case,

local governments could lease, with certain restrictions, the properties acquired for boating facilities. For instance, the lease might stipulate that: (1) a substantial initial investment within a certain period of time would be required; (2) additional improvements would be provided periodically; and (3) all development plans must be submitted for approval and must meet certain minimum standards. If the public acquires sites for boating facilities and then either operates them or leases them to private developers the needs of the boating public will be satisfied and the municipality assured that these properties will remain in use as boating facilities.

Gifts and transfers.--Many landowners have bequeathed land to public agencies in wills and, in many cases, have donated land prior to death provided a life estate in the property may be retained. In Massachusetts, through the pioneer work of the Trustees of Reservations, many such gifts of land have been received, and, in California, state park authorities have acquired land for recreational purposes by designating memorials to such donors. In Monterey County, California, a group of citizens solicited gifts of easements from landowners, and gifts of money to buy easements. One such campaign started in June, 1959; by August, gifts of 4000 acres had been pledged.[40]

Federal and state agencies building multi-purpose reservoirs or other water-oriented projects often give local public agencies a chance to acquire, by gift or at a nominal fee, waterfront lands or access to the shoreline.

An example is the considerable amount of land transferred to state and local governments by the Tennessee Valley Authority. More than 150,000 acres of land have been so transferred and this land is generally available for recreational use.[41] These public areas range in size from public access areas of five acres or less to wildlife management and public shooting areas of several thousand acres.

Also, departments within local governments frequently transfer land no longer needed or desirable for a certain purpose. In the City of New York each department must notify all other city departments when a tract of land is no longer needed for its present use, thereby providing an opportunity to obtain the transfer of such property.[42]

Tax foreclosure.--One of the most common devices for acquiring land for recreational purposes is an energetic foreclosure program on tax delinquent property. It is not essential that the tax parcels be located along waterways because they can often be traded for property that is suitable for boating facilities.

Even in the absence of specific statutory authority, the local government's authority to devote tax delinquent land to recreational use is not likely to be questioned. Nor can its authority be seriously contested if the public agency uses such land for trading purposes.[43]

Urban and rural redevelopment.--The opportunity of providing marine facilities along a waterfront which has been pre-empted by other uses should not be overlooked when plans for the redevelopment of a blighted

area are initiated. For example, Nashville, Tennessee, and Chicago, Illinois, have included marinas in their urban redevelopment schemes. The providing of boating facilities in both urban and rural redevelopment areas should be given consideration.

Formal and informal agreements.--A co-operative effort between several governments or a public agency and private developers might be one of the best methods for providing boating facilities. Two or more local governments might jointly provide adequate facilities whereas one government might not be financially capable of providing such improvements. Likewise, a private developer might agree to provide boating facilities which are revenue producers but find it financially non-feasible to provide such facilities as launching ramps. The provision of ramps and other non-revenue producing facilities might be undertaken by local governments.

Zoning of boating facility sites.--If sufficient land is acquired and the site is properly planned, a boating facility which does not include marinas where persons reside on board boats might be located in any zoning district. Boating facilities may be listed as a permitted use in any zoning district in which their location is desired.

An alternative is to establish "recreational" districts. This has been done along the ocean in certain areas of California and the zoning has been upheld by the courts.[44] In other states recreation districts have been held invalid. The legality of recreation districts will continue to be

contested and the results of such cases should be followed attentively.

One approach to the zoning of recreation boating sites in suburban areas is to grant municipalities extraterritorial zoning powers. The advantage of this procedure is that the city normally has both the administrative organization to accomplish the job effectively and at the same time the motivation to do so because the areas involved are usually of major importance to the municipality. The constitutionality of such grants has been established where the jurisdictional area involved is reasonable and where the residents of the unincorporated area are properly represented.

In recent years it has been widely recognized that the application of zoning to areas within municipal boundaries only is unrealistic because of the increasing development occurring outside municipal boundaries. Numerous states have authorized county zoning--Wisconsin has authorized a special type of rural zoning. In this state counties may establish districts for agricultural, forestry or recreational use. County zoning has the advantage, in most cases, of providing a wide geographic coverage but unless the county government is permitted to zone portions of its area of jurisdiction, as well as its entirety, county zoning cannot usually be enacted because of the opposition of rural people.

Land under water contiguous to boating facilities should also be zoned to prevent undesirable development. Some of the difficulties which complicate the zoning of bodies of water are pointed out in the January,

1959, report of the Planning Advisory Service.[45] They include: (1) extension of boundary lines that intersect the shore line at an angle; (2) determining the location of boundary lines that are "perpendicular" or radial to a curving shore line; (3) determining what the shore line is (there are many terms, some more clearly defined and more acceptable legally than others); and (4) deciding what is "midway" in an irregularly shaped body of water. The zoning of land under water needs much further study.

Summary

Where navigable waterways are present, local governments should complete a recreation boating study. The study would consist of three phases: (1) an inventory of recreation boating: (2) a study of the demand for boating facilities; and (3) an analysis of the findings and the development of a plan.

The boating facilities plan should consist of a text and a map. The text should explain the purpose and function of the plan, describe each site, discuss priorities, set forth minimum site development standards and present the tools recommended for carrying out the plan.

The map should show existing and proposed facilities and other pertinent data.

There are many tools which might be utilized to implement the boating facilities plan. The more important tools are purchase and leaseback, gifts and transfers, tax foreclosures, urban and rural redevelopment,

formal and informal agreements and zoning. However, the tools selected will depend upon the local situation; therefore, a thorough investigation should be made of all available tools to determine which are the most appropriate.

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